

TFT LCD Preliminary Specification

MODEL NO.: M170E7-L02

Customer: _____

Approved by: _____

Note: (Preliminary spec. for reference only)

Liquid Crystal Display Division	
QRA Division	OA Head Division
Approval	Approval
	

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Issued Date: Dec. 13, 2005

Model No.: M170E7-L02

Preliminary**REVISION HISTORY**

Version	Date	Section	Description
Ver. 1.0	Dec. 13, 05	-	M170E7-L02 preliminary specification was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The M170E7-L02 model is a 17.0 inch TFT-LCD module with a 4-CCFL Backlight Unit and a 30-pin 2ch-LVDS interface. This module supports 1280 x 1024 SXGA mode and displays 16.2M colors. The inverter module for the Backlight Unit is not built in.

1.2 FEATURES

- Wide viewing angle
- High contrast ratio
- Fast response time
- High color saturation (EBU Like Specifications)
- SXGA (1280 x 1024 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Compact size and slim border
- RoHS compliance

1.3 APPLICATION

- TFT LCD Monitor

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	337.92 (H) x 270.34 (V) (17.0" diagonal)	mm	(1)
Bezel Opening Area	340.92 (H) x 273.34 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 1024	pixel	-
Pixel Pitch	0.264 (H) x 0.264 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.2M	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), AG (Haze 25%)	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	354.42	354.92	355.42	mm	(1)
	Vertical(V)	289.84	290.34	290.84	mm	
	Depth(D)	-	12.8	13.3	mm	
Weight		-	1825	1895	g	-
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.5	G	(4), (5)

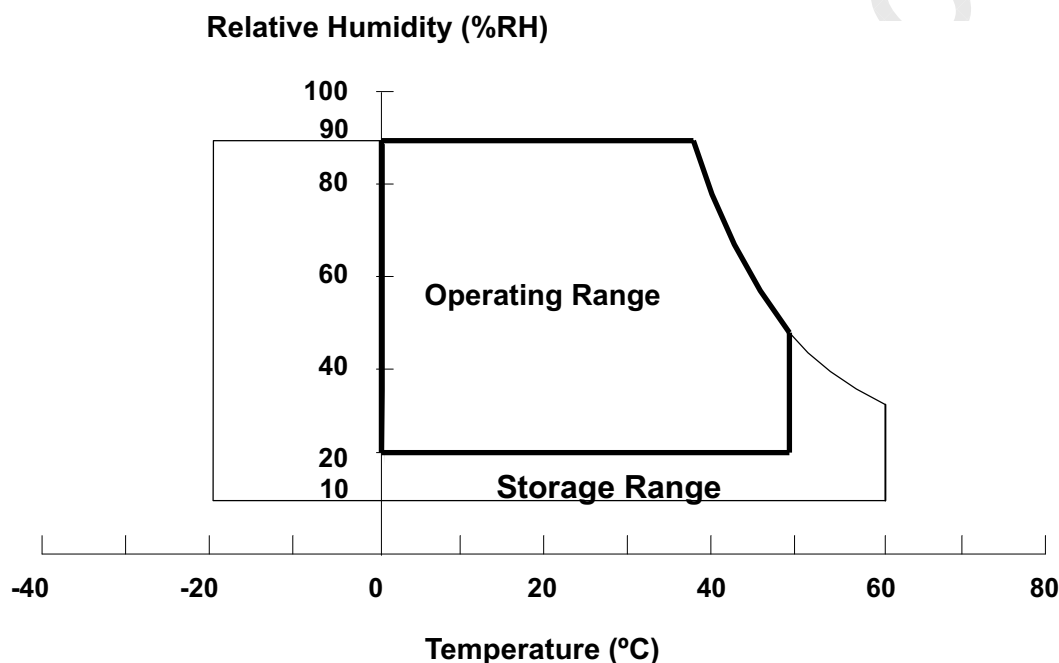
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40\text{ }^{\circ}\text{C}$).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 °C Min. and 60 °C Max.

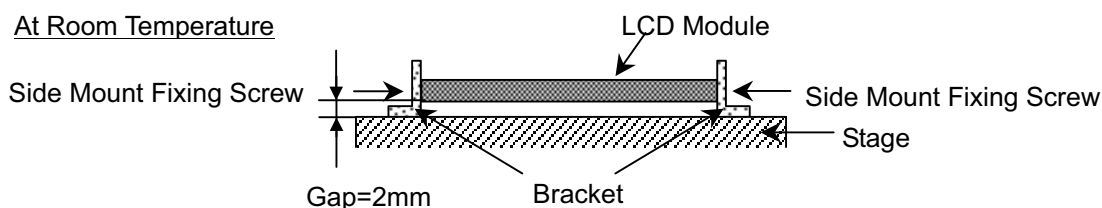


Note (3) 11ms, half sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$.

Note (4) 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{CC}	-0.3	+6.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	4.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V _L	-	2.5K	V _{RMS}	(1), (2), I _L = 6.5 mA
Lamp Current	I _L	2.0	7.0	mA _{RMS}	
Lamp Frequency	F _L	-	80	KHz	

Note (1) Permanent damage might occur if the module is operated at conditions exceeding the maximum values.

Note (2) Specified values are for lamp (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

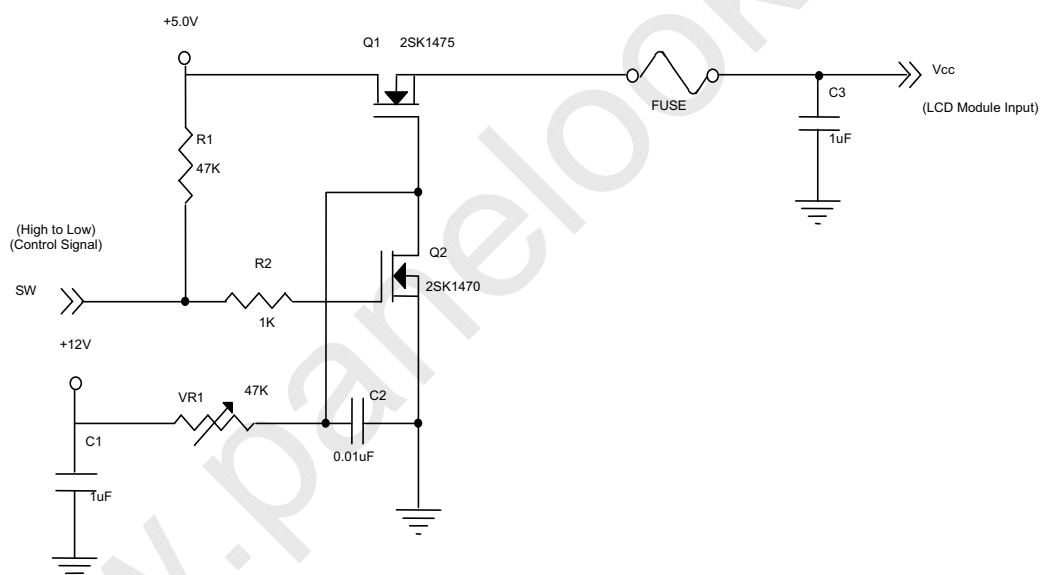
3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

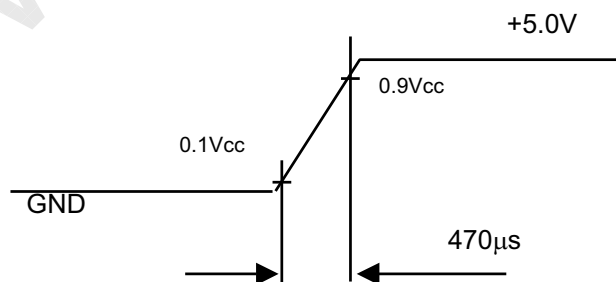
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V _{CC}	4.5	5.0	5.5	V	-
Ripple Voltage	V _{RP}	-	--	100	mV	-
Rush Current	I _{RUSH}	-	--	3.8	A	(2)
Power Supply Current	White	-	420	590	mA	(3)a
	Black	-	570	800	mA	(3)b
	f _V = 75Hz, V _{CC} =4.5V	-	-	1200	mA	(4)
LVDS differential input voltage	V _{id}	-100	-	+100	mV	
LVDS common input voltage	V _{ic}	--	1.2	--	V	

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:



Vcc rising time is 470μs





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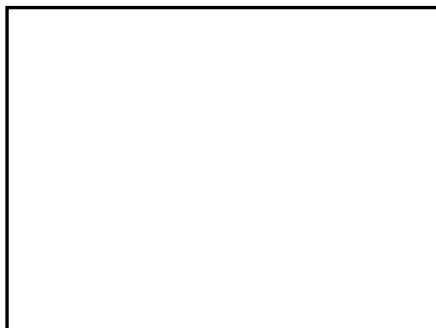
Issued Date: Dec. 13, 2005

Model No.: M170E7-L02

Preliminary

Note (3) The specified power supply current is under the conditions at $V_{cc} = 5.0\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

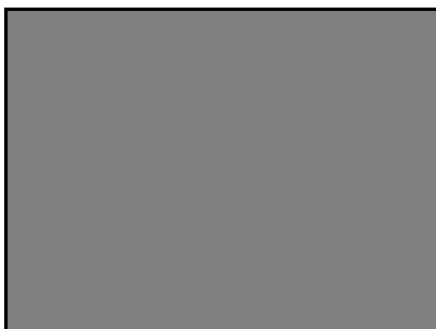
b. Black Pattern



Active Area

Note (4) The specified power supply current is under the conditions at $V_{cc} = 4.5\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 75\text{ Hz}$, whereas a power dissipation check pattern (Black Pattern) below is displayed.

Black Pattern

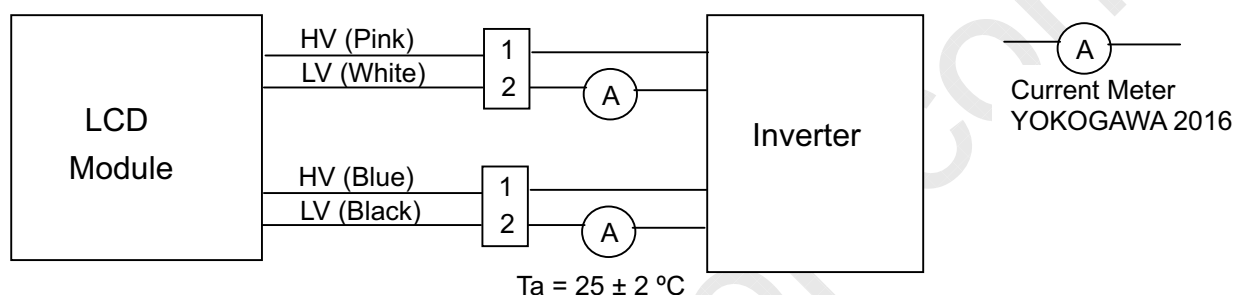


Active Area

3.2 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	585	650	715	V_{RMS}	$I_L = 7.0 \text{ mA}$
Lamp Current	I_L	2.0	6.5	7.0	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	1260(25 °C)	V_{RMS}	(2)
		-	-	1500 (0 °C)	V_{RMS}	(2)
Operating Frequency	F_L	40	60	80	KHz	(3)
Lamp Life Time	L_{BL}	50,000	-	-	Hrs	(5) $I_L = 6.5 \text{ mA}$
Power Consumption	P_L	-	16.9	-	W	(4), $I_L = 6.5 \text{ mA}$

Note (1) Lamp current is measured by utilizing high-frequency current meters as shown below:



Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise, the lamp may not be turned on normally.

Note (3) The lamp frequency may produce interference with horizontal synchronization frequency from the display, which might cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronization frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L \times 4 \text{ CCFLs}$

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$ and $I_L = 6.5 \text{ mA}_{RMS}$ until one of the following events occurs:

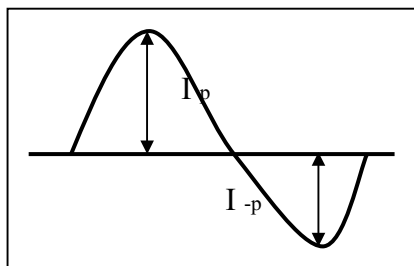
- (a) When the brightness becomes or lower than 50% of its original value.
- (b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform. (Unsymmetrical ratio is less than 10%) Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

- The asymmetry rate of the inverter waveform should be 10% below;
- The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;
- The ideal sine wave form shall be symmetric in positive and negative polarities.



* Asymmetry rate:

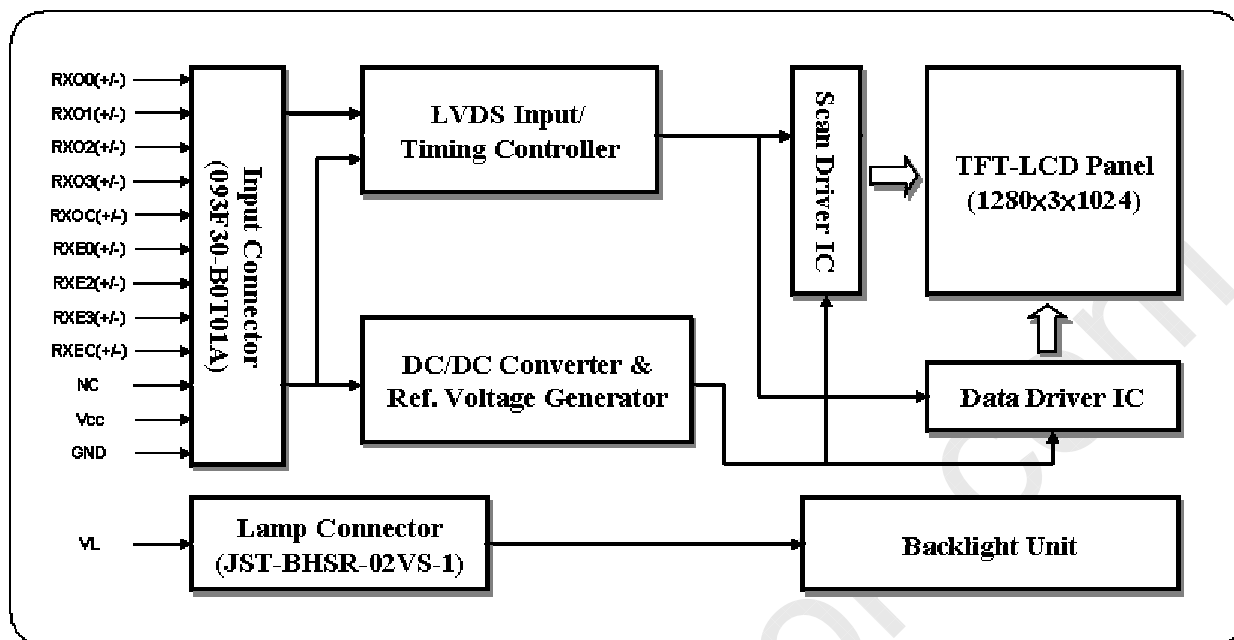
$$|I_p - I_{-p}| / I_{rms} * 100\%$$

* Distortion rate

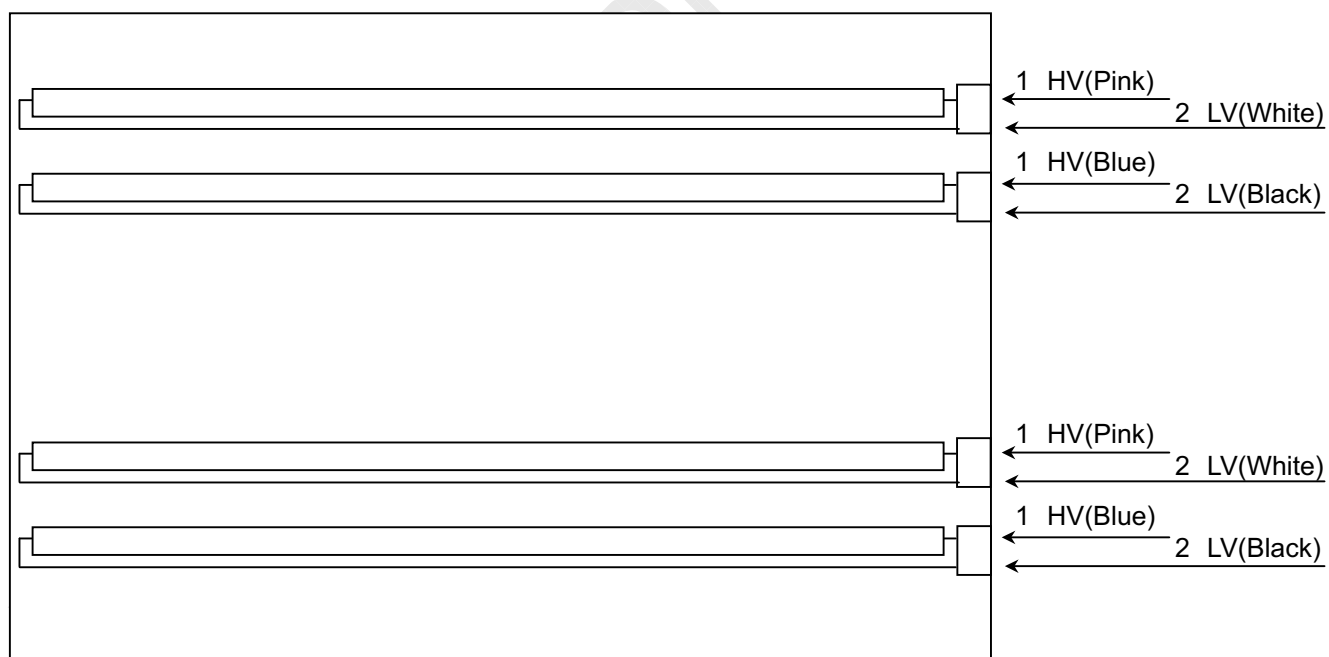
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Name	Description
1	RX00-	Negative LVDS differential data input. Channel O0 (odd)
2	RX00+	Positive LVDS differential data input. Channel O0 (odd)
3	RX01-	Negative LVDS differential data input. Channel O1 (odd)
4	RX01+	Positive LVDS differential data input. Channel O1 (odd)
5	RX02-	Negative LVDS differential data input. Channel O2 (odd)
6	RX02+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RXOC-	Negative LVDS differential clock input. (odd)
9	RXOC+	Positive LVDS differential clock input. (odd)
10	RX03-	Negative LVDS differential data input. Channel O3(odd)
11	RX03+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)
23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	Not connecting(should keep open)
26	NC	Not connecting(should keep open)
27	NC	Not connecting(should keep open)
28	VCC	+5.0V power supply
29	VCC	+5.0V power supply
30	VCC	+5.0V power supply

Note (1) Connector Part No.: FI-XB30SRL-HF11(JAE).

Note (2) Mating Connector Part No.:FI-X30H ; FI-X30C* ; FI-X30M* ; FI-X30HL(-T),FI-X30C*L(-T) [JAE]

Note (3) The first pixel is odd.

Note (4) Input signal of even and odd clock should be the same timing.



LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6
LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6

5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Remark
1	HV	High Voltage	Pink
2	LV	Low Voltage	White
1	HV	High Voltage	Blue
2	LV	Low Voltage	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent (YEON HO_LOCKING TYPE 35001HS-02L)

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB (JST) or equivalent [35001TS-L (YEON HO)]

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
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	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

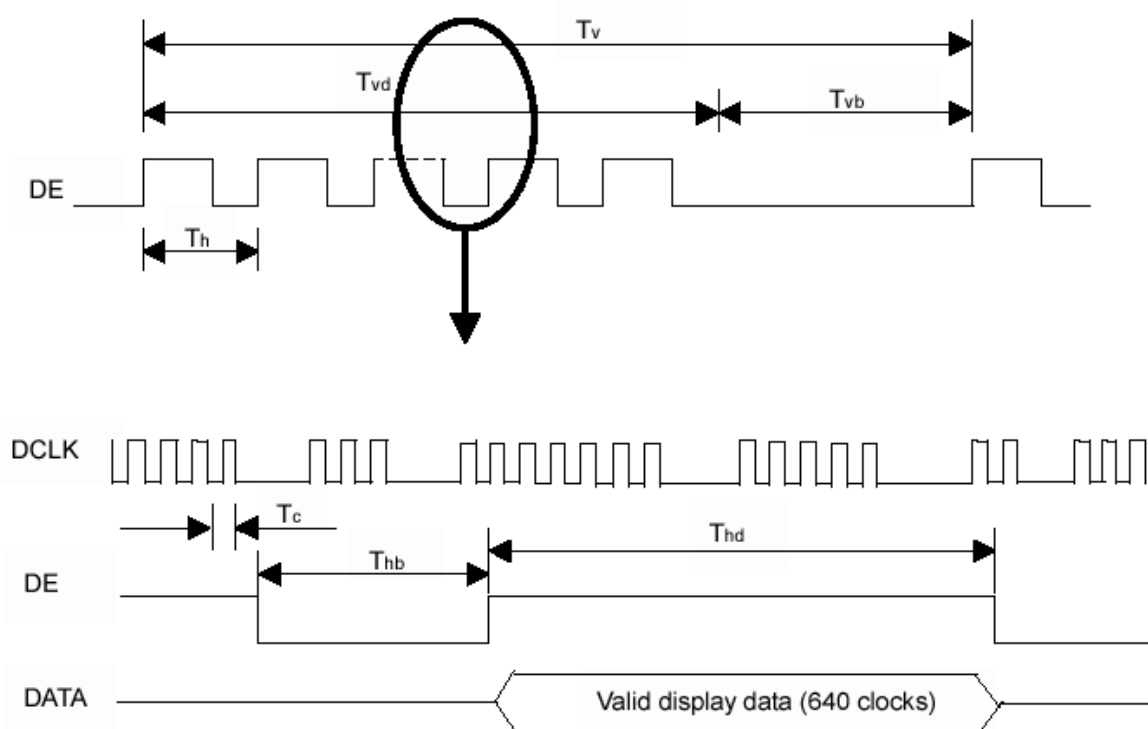
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	-	54	67.5	MHz	-
	Period	Tc	14.8	18.5	-	ns	-
	High Time	Tch	-	4/7	-	Tc	-
	Low Time	Tcl	-	3/7	-	Tc	-
LVDS Data	Setup Time	Tlvs	600	-	-	ps	-
	Hold Time	Tlvh	600	-	-	ps	-
Vertical Active Display Term	Frame Rate	Fr	56	60	75	Hz	Tv=Tvd+Tvb
	Total	Tv	1034	1066	1274	Th	-
	Display	Tvd	1024	1024	1024	Th	-
	Blank	Tvb	Tv-Tvd	42	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	690	844	960	Tc	Th=Thd+Thb
	Display	Thd	640	640	640	Tc	-
	Blank	Thb	Th-Thd	204	Th-Thd	Tc	-

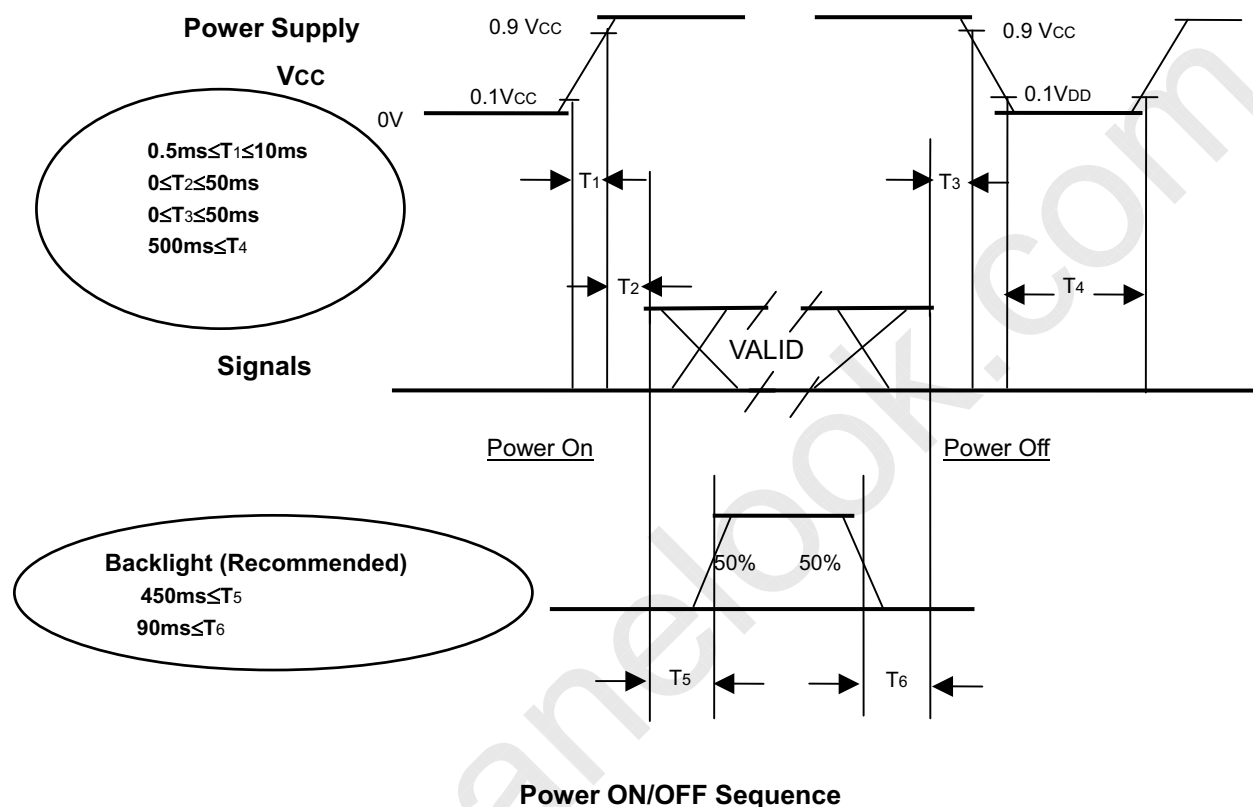
Note : (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



Note.

- (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.
- (2) Please apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation of the LCD turns off, the display may, instantly, function abnormally.
- (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T4 should be measured after the module has been fully discharged between power on/off periods.
- (5) Interface signal shall not be kept at high impedance when the power is on.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

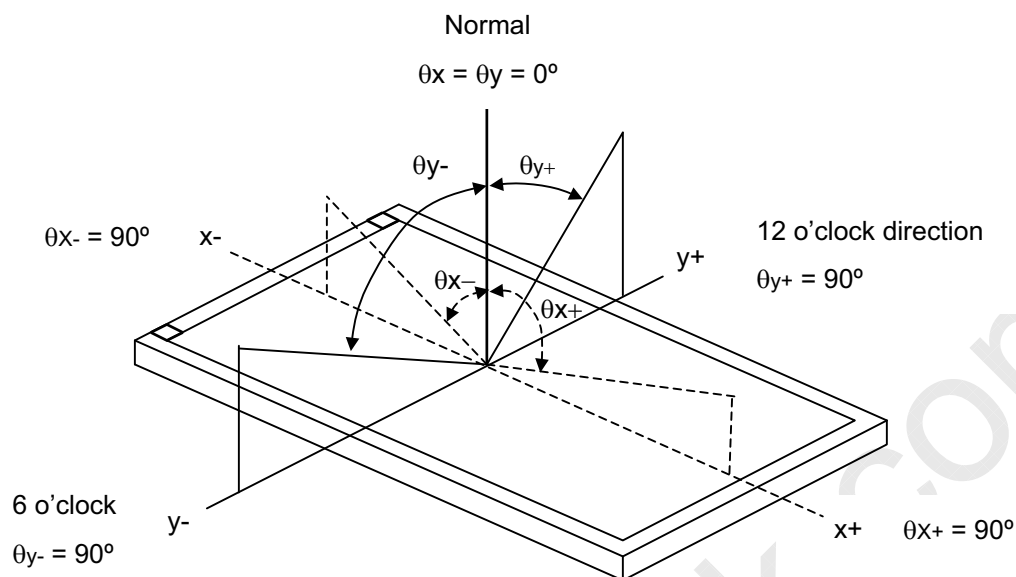
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I _L	6.5	mA
Inverter Driving Frequency	F _L	61	KHz
Inverter	SUMIDA H05-5307		

7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	R _x	$\theta_x=0^\circ, \theta_Y=0^\circ$ CS-1000T R=G=B=255 Grayscale	Typ. -0.03	0.647	Typ. +0.03	---	(1), (6)
		R _y			0.333			
	Green	G _x			0.282			
		G _y			0.606			
	Blue	B _x			0.152			
		B _y			0.073			
	White	W _x			0.313			
		W _y			0.329			
Color Chromaticity (CIE 1976)	Red	R _{u'}		0.411	0.454	---		
		R _{v'}		0.503	0.526	---		
	Green	G _{u'}	---	0.116	0.140			
		G _{v'}	0.548	0.562	---			
	Blue	B _{u'}	0.150	0.170	---			
		B _{v'}	---	0.184	0.224			
Center Luminance of White		L _w	230	300	---	cd/m ²	(4), (6)	
Color Gamut		C.G.	$\theta_x=0^\circ, \theta_Y=0^\circ$	---	72	---	%	(6), (7)
Contrast Ratio		CR	CS-1000T	450	700	---	-	(2), (6)
Response Time		T _R	$\theta_x=0^\circ, \theta_Y=0^\circ$	---	1	6	ms	(3)
		T _F		---	4	9		
Luminance Uniformity (9 points)		δW	$\theta_x=0^\circ, \theta_Y=0^\circ$ CA210	---	---	1.4	-	(6), (7)
Viewing Angle	Horizontal	θ _{x+}	CR ≥ 10 BM-5A	---	(80)	---	Deg.	(1), (6)
		θ _{x-}		---	(80)	---		
	Vertical	θ _{Y+}		---	(80)	---		
		θ _{Y-}		---	(80)	---		
Safety	Luminance uniformity – Angular dependence		CS-1000T R=G=B= 255 Grayscale R=G=B= 0 Grayscale	---	---	1.7	---	(9)
	Luminance contrast – Angular dependence			0.8	---	---	---	(10)
	Colour uniformity – Angular dependence			---	---	0.025	---	(9)(11)

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_w / L_d$$

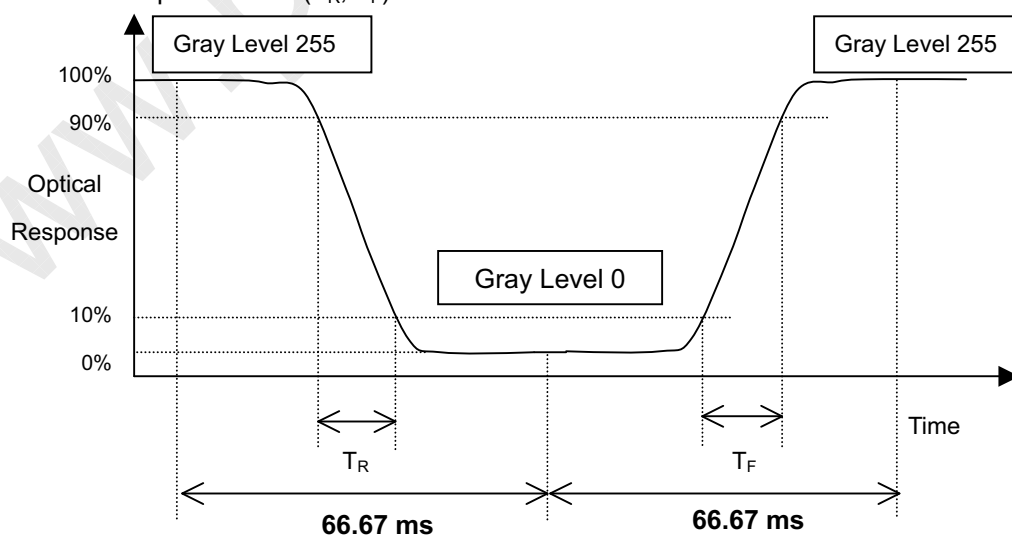
L_w : Luminance of gray level 255

L_d : Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (7).

Note (3) Definition of Response Time (T_R , T_F) and measurement method:



Note (4) Definition of Luminance of White (L_w) :

Measure the luminance of gray level 255 at center point

$$L_w = L(5)$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (7).

Note (5) Definition of Luminance of Dark (L_d) :

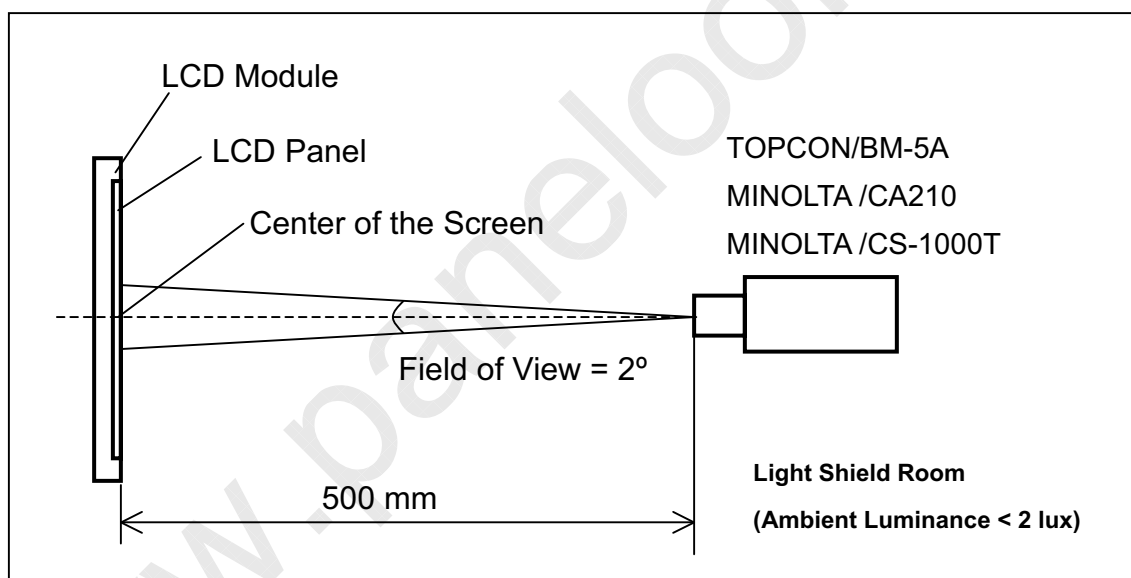
Measure the luminance of gray level 0 at center point

$$L_d = L(5)$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (7).

Note (6) Measurement Setup:

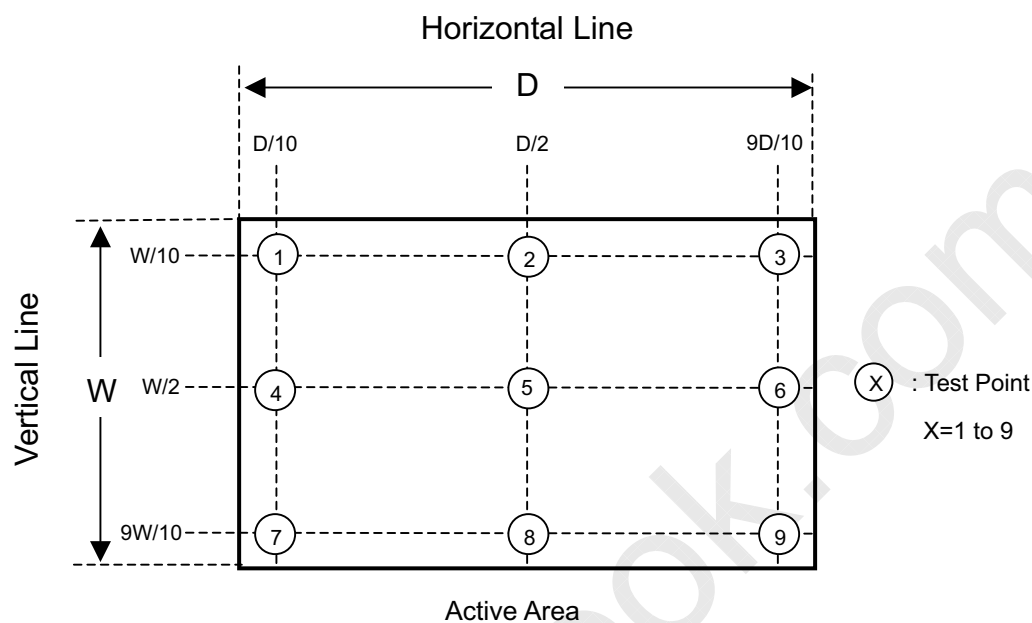
The LCD module should be stabilized at given temperature for **15 minutes** to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for **15 minutes** in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

$$\delta W = \text{Maximum } [L(1), L(2) \dots L(4), L(9)] / \text{Minimum } [L(1), L(2) \dots L(4), L(9)]$$



Note (8) Definition of color gamut (C.G):

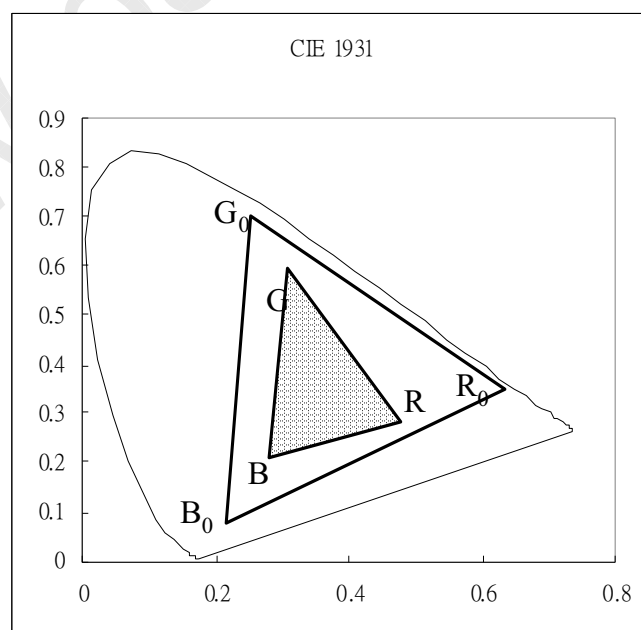
$$C.G = \Delta R G B / \Delta R_0 G_0 B_0 \cdot 100\%$$

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

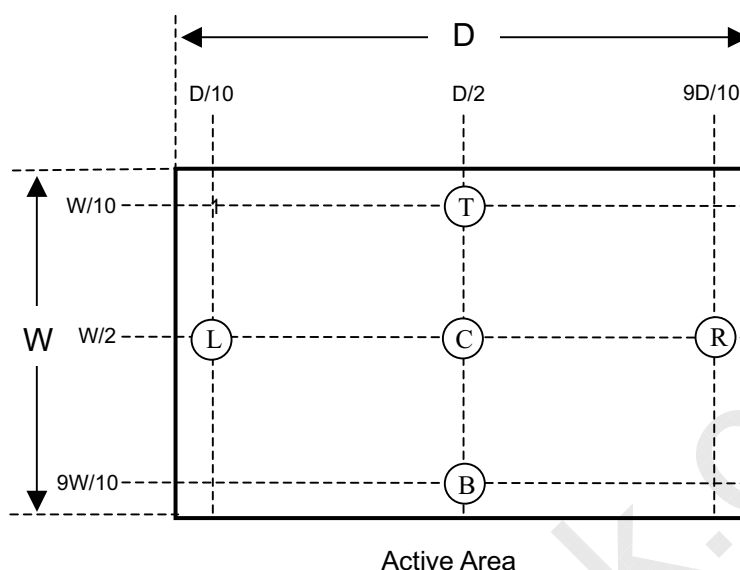
R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

$\Delta R_0 G_0 B_0$: area of triangle defined by R_0, G_0, B_0

$\Delta R G B$: area of triangle defined by R, G, B



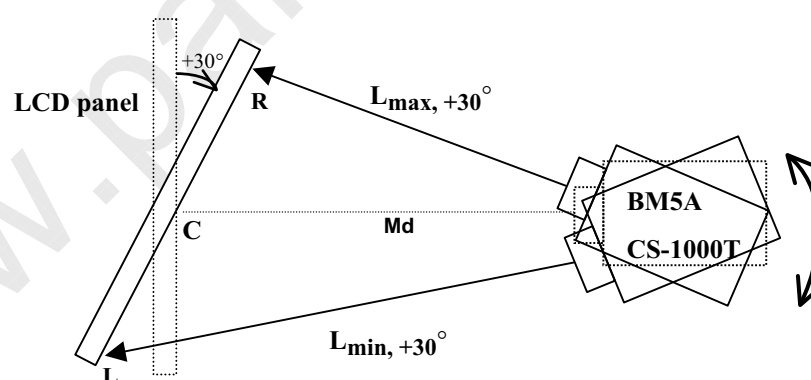
Note (9) Definition of Luminance Uniformity – Angular dependent :



Luminance is measured at the center measurement position "C" on the LCD panel. The optical axis of meter shall be aligned with the normal of the panel surface. The measuring distance between the meter and the surface of the panel is defined as:

$$Md \text{ (cm)} = \text{diagonal of the panel (cm)} \times 1.5 \quad \text{with minimum distance 50 cm.}$$

a. Horizontal - mode

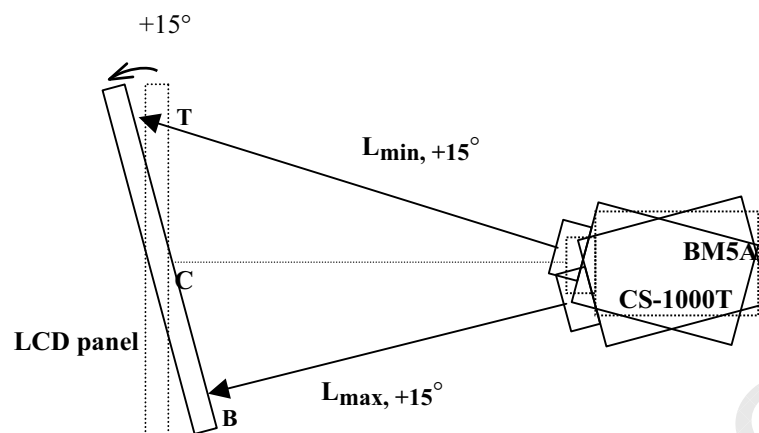


The LCD panel is then rotated to another azimuthal angle to -30° ; and $L_{\min, -30^\circ}$ and $L_{\max, -30^\circ}$ are obtained by using the same procedure.

The Luminance Uniformity is calculated as follow:

$$((L_{\max, +30^\circ} / L_{\min, +30^\circ}) + (L_{\max, -30^\circ} / L_{\min, -30^\circ})) / 2.$$

b. Vertical - mode



The LCD panel is then rotated to another azimuthal angle to -15° ; and $L_{\min, -15^\circ}$ and $L_{\max, -15^\circ}$ are obtained by using the same procedure.

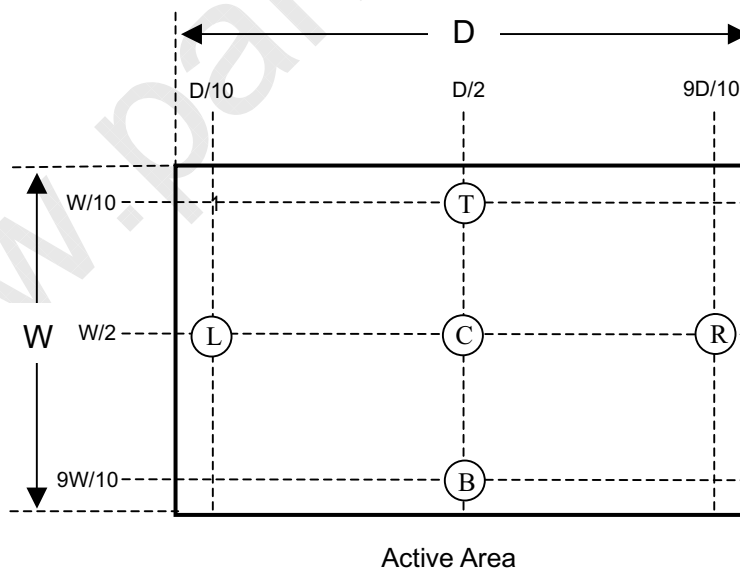
The Luminance Uniformity is calculated as follow:

$$L_{\max, +15^\circ} / L_{\min, +15^\circ}$$

$$L_{\max, -15^\circ} / L_{\min, -15^\circ}$$

The largest value shall be reported.

Note (10) Definition of Luminance Contrast – Angular dependent :





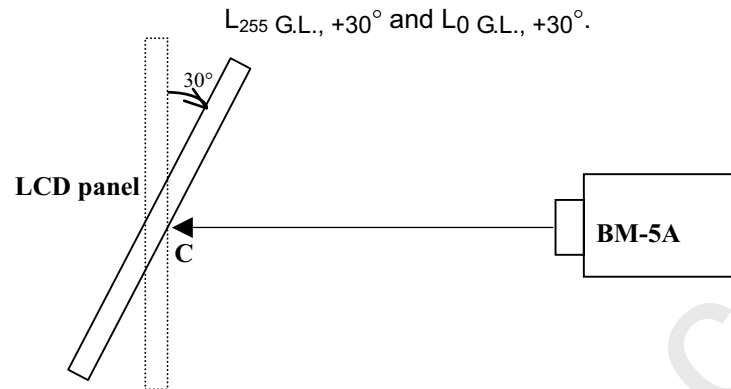
CHI MEI
OPTOELECTRONICS CORP.

Issued Date: Dec. 13, 2005

Model No.: M170E7-L02

Preliminary

Luminance contrast is measured at the center point of the LCD panel "C" along with the normal of the display with the same distance described in Note (9). The display is then rotated around the vertical axis by changing its azimuthal axis to +30°; and this gives:



The LCD panel is then rotated to azimuthal angle to -30°; and L_0 G. L., -30° and L_{63} G.L., -30° are obtained by using the same procedure. The Luminance Contrast is calculated:

$$(L_{255} \text{ G. L.} - L_0 \text{ G.L.}) / (L_{255} \text{ G. L.} + L_0 \text{ G.L.})$$

For both +30° and -30°. The lowest value shall be reported.

Note (11) Definition of Colour uniformity – Angular dependence :

From Note (9), it can measure the data as below chart.

	Measuring point R		Measuring point L		$\Delta u'v'$
	u'_R	v'_R	u'_L	v'_L	
+30°					
-30°					

$$\Delta u'v' = \sqrt{(u'_R - u'_L)^2 + (v'_R - v'_L)^2}$$

For both +30° and -30°. The largest value in $\Delta u'v'$ shall be reported.

8. PACKAGING

8.1 PACKING SPECIFICATIONS

- (1) 5 LCD modules / 1 Box
- (2) Box dimensions: 534(L) X 316(W) X 462(H) mm
- (3) Weight: approximately 12Kg (5 modules per box)

8.2 PACKING METHOD

- (1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 60cm	Non Operation

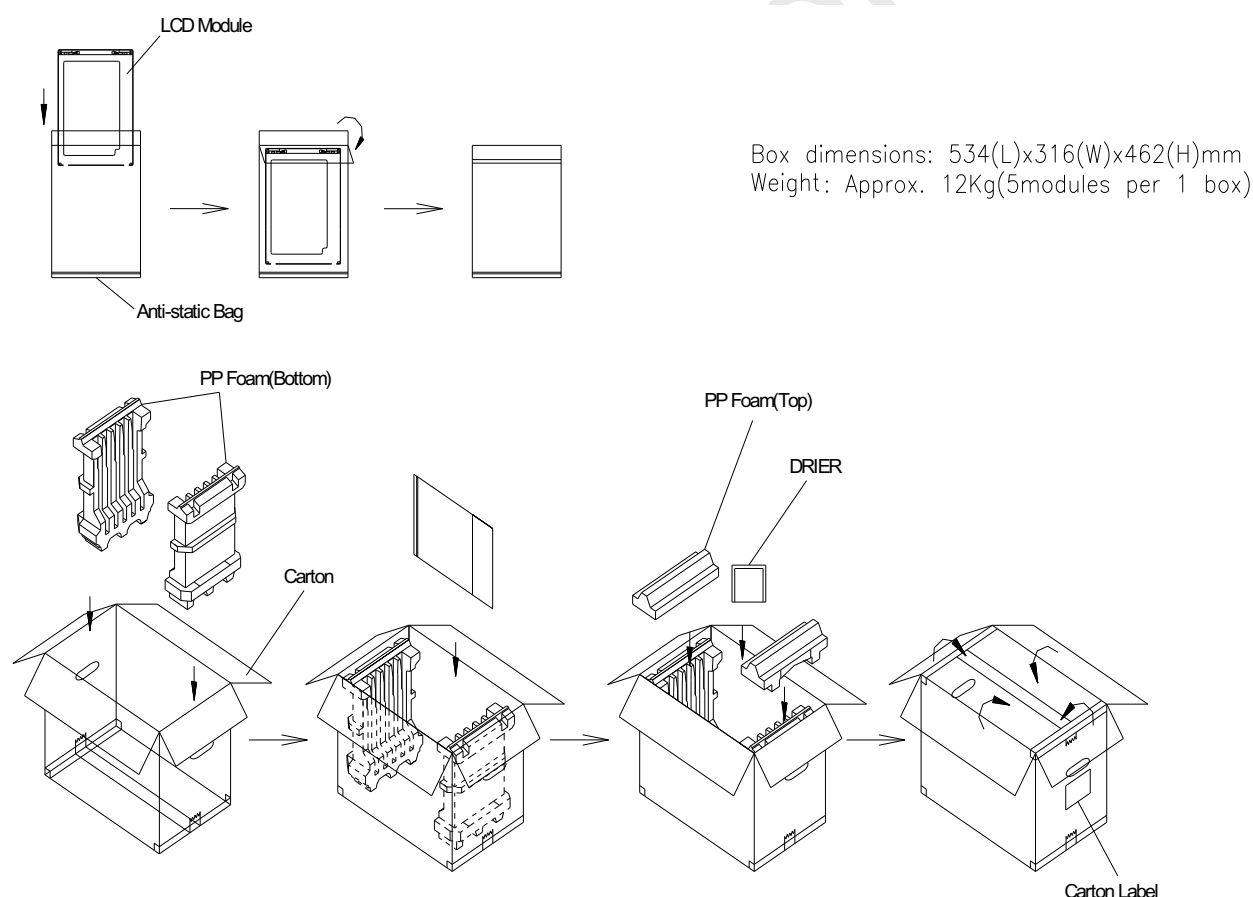


Figure. 8-1 Packing method

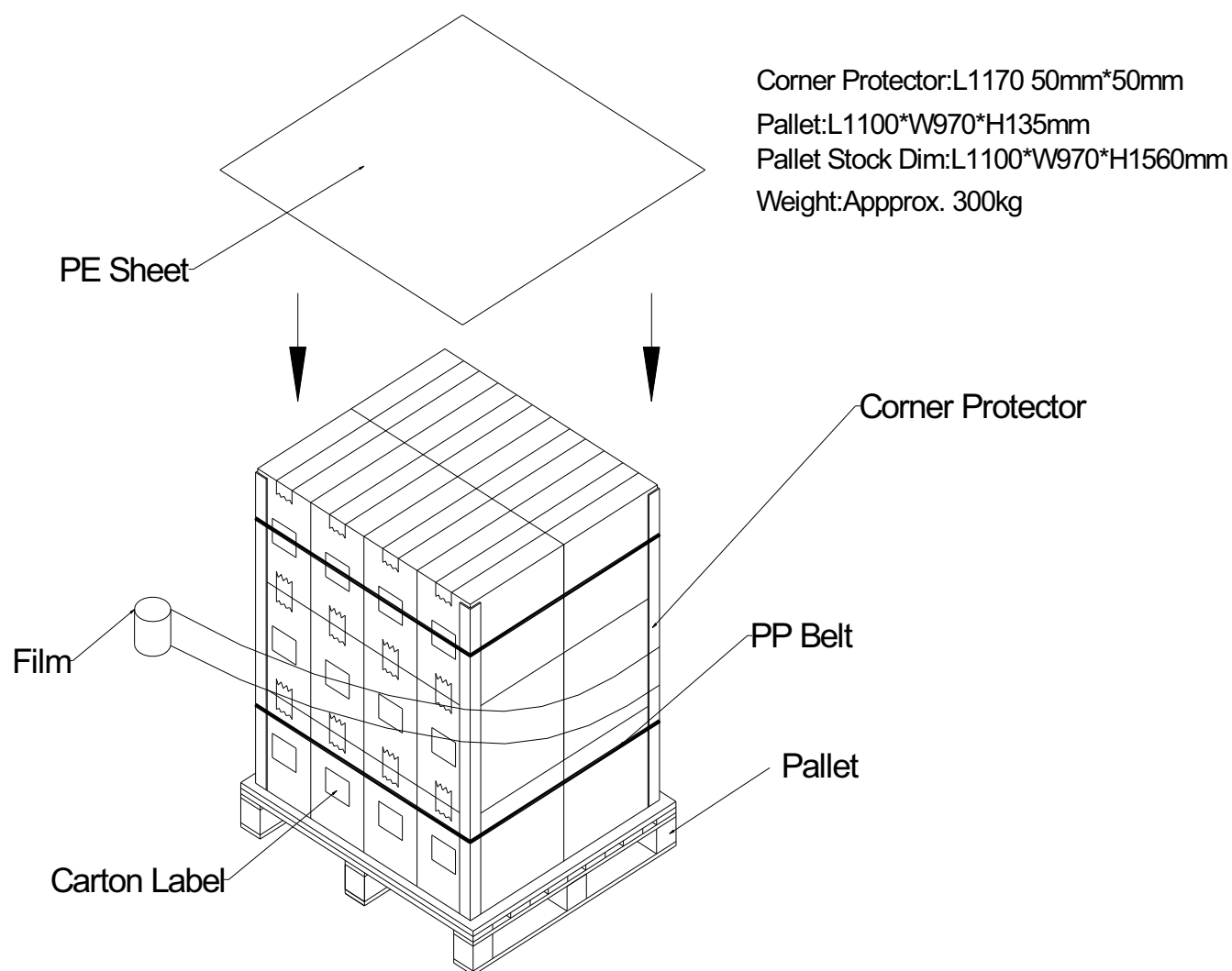


Figure. 8-2 Packing method

9. DEFINITION OF LABELS

9.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: M170E7-L02
- (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.
- (c) CMO barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

Code	Meaning	Description
XX	CMO internal use	-
XX	Revision	Cover all the change
X	CMO internal use	-
XX	CMO internal use	-
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U.
L	Product line #	Line 1=1, Line 2=2, Line 3=3, ...
NNNN	Serial number	Manufacturing sequence of product

- (d) Customer's barcode definition:

Serial ID: CM-17E72-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	CMO=CM
17E72	Model number	M170E7-L02 = 17E72
X	Revision code	Non ZBD: 1,~,9,0 / ZBD: A~Z
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M
X	Gate driver IC code	
XX	Cell location	Tainan Taiwan=TN, Ningbo China=CN
L	Cell line #	1~12=0~C
XX	Module location	Tainan Taiwan=TN, Ningbo China=CN
L	Module line #	1~12=0~C
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, T, U, V
NNNN	Serial number	By LCD supplier

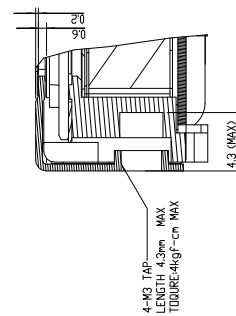
10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

10.2 SAFETY PRECAUTIONS

- (1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.



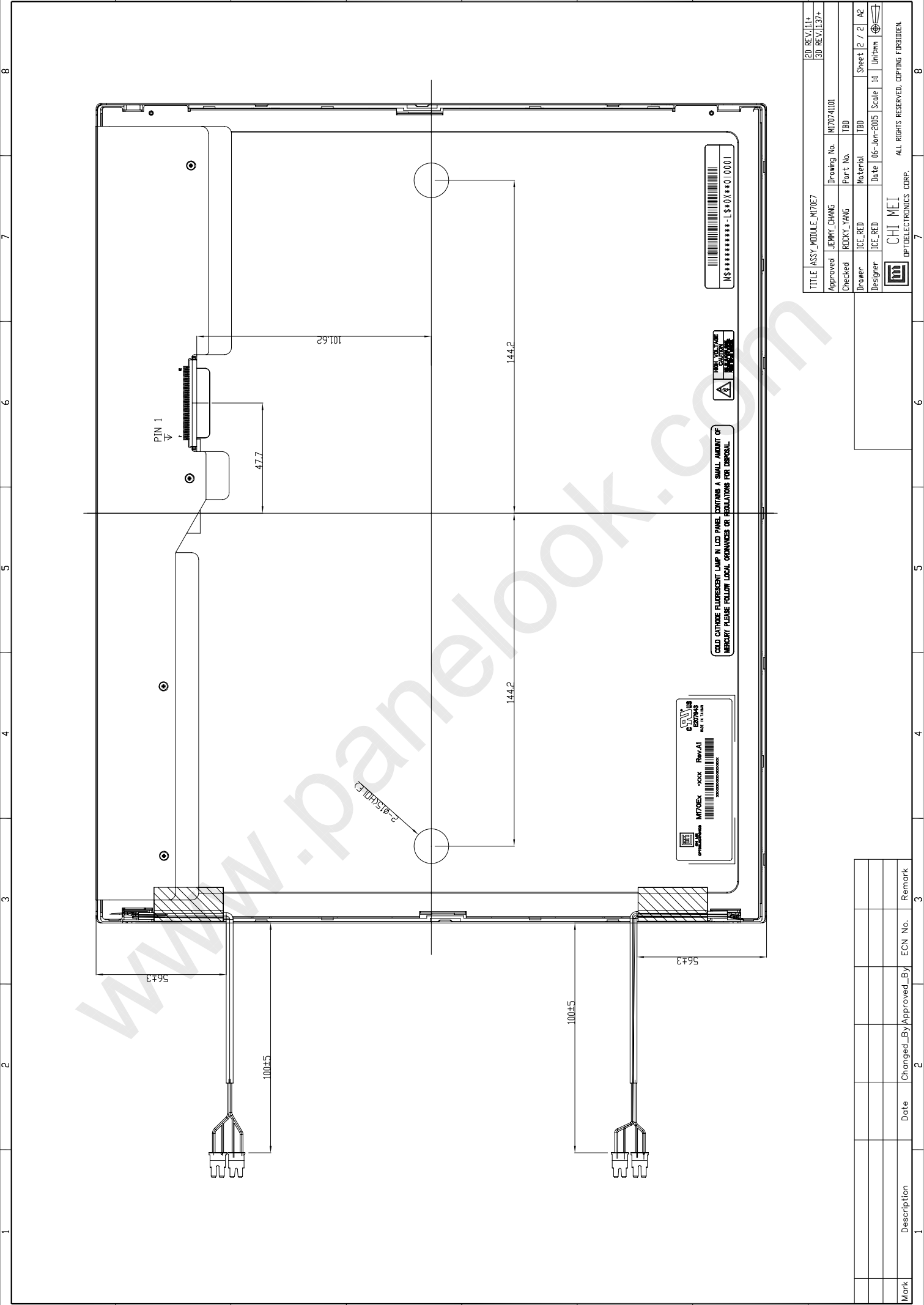
NOTES:

1. OUTLINE TOLERANCE: $\pm 0.5\text{mm}$.
2. 2.2" * " MARKS THE DESIGN CRITICAL DIMENSION.
3. 3.0" @ " MARKS THE PROCESS CRITICAL DIMENSION.
4. MAX. SCREW LENGTH: 4.3 mm.
5. MAX. SCREW TORQUE: 4 kg-cm.
6. 1/F CONNECTOR FI-XB30SR(JAE) OR EQUIVALENT
7. LAMP CONNECTOR WIRE : JST BHSR-02VS-1 OR EQUIVALENT

TITLE		ASSY. MIDDLE_M7067		20 REV. 1		30 REV. 137*	
Approved		JERRY CHANG		Drawing No.		M7074100	
Checked		ROCKY WANG		Part No.		TBD	
Packaged		ICE_REID		Material		TBD	
Designed		ICE_REID		Date		25-Feb-2005	
				Scale		1:1	
				Sheet		1 / 2	
				Units		mm	

Mark	Description	Date	Channel	Approved By	FCN No.	Remark

SECTION A-A
SCALE 5:1



TITLE		ASSY_MODULE_M70E7		2D REV.11+		3D REV.137+	
Approved		JEWY.CHANG		Drawing No.		M7074101	
Checked		RICKY YANG		Part No.		TBD	
Drawer		ICE RED		Material		TBD	
Designer		ICE RED		Date		06-Jun-2005	
				Scale		1:1	
				Sheet		2 / 2	
				Unit		mm	